10.546 A.D. 1845.

— Selby

Machine for Cutting off the Two Ends of a Pipe.

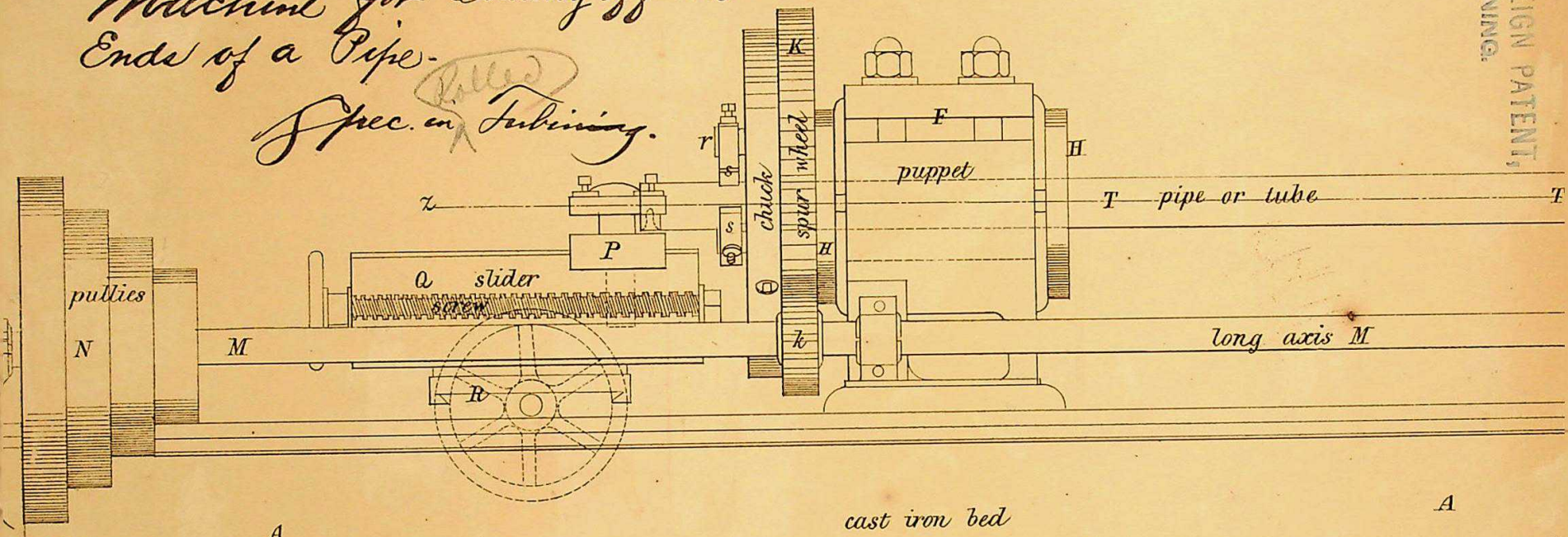
Spec. en Tabrinay.

82. METAL WORKING, Turning, Misc.

82. TURNING. FOREIGN PATENTS.

41

FIGURE. 2. *Elevation of the back*



10546
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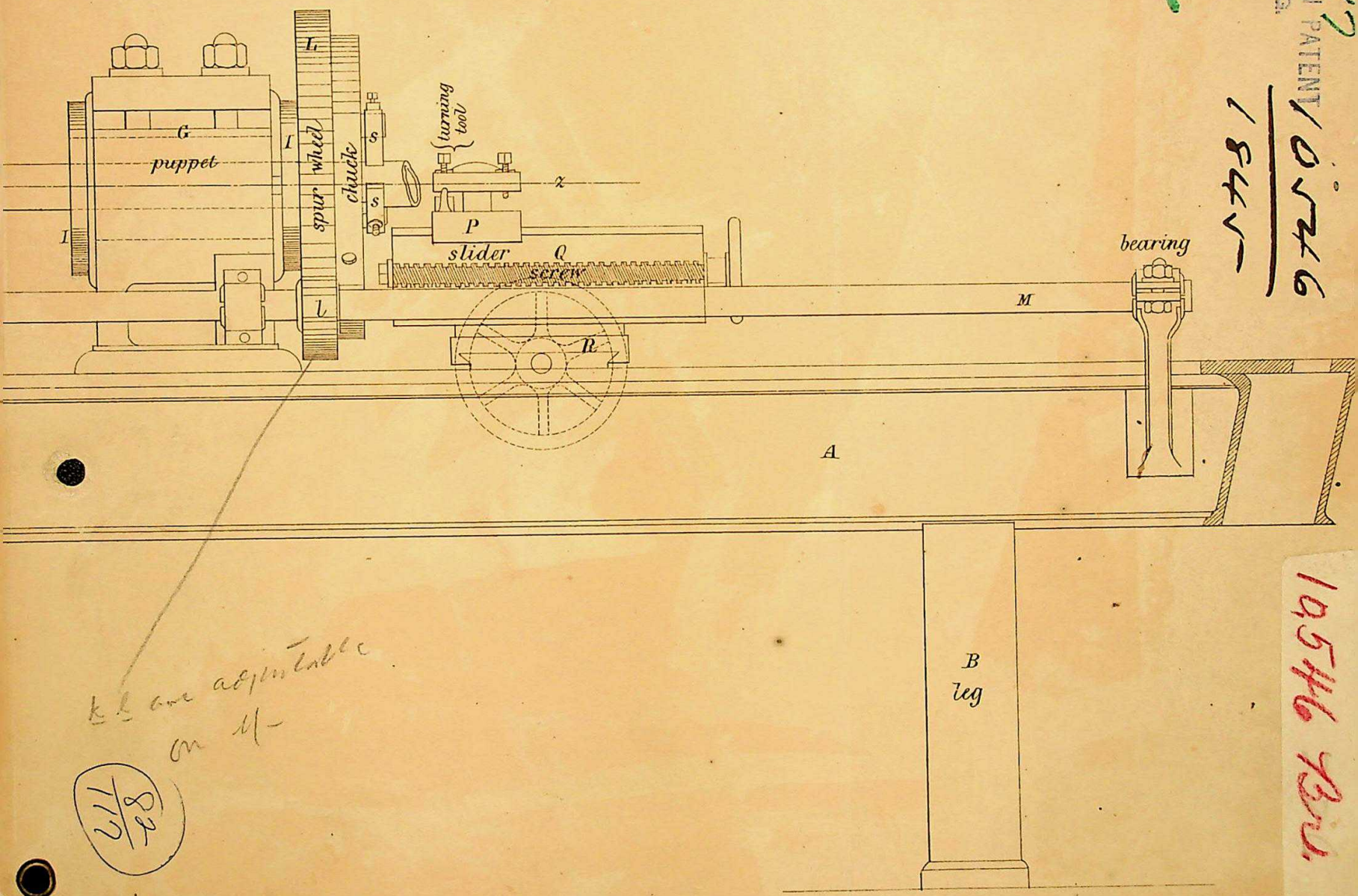
of the machine



0.546 A.D. 1845.

Selby

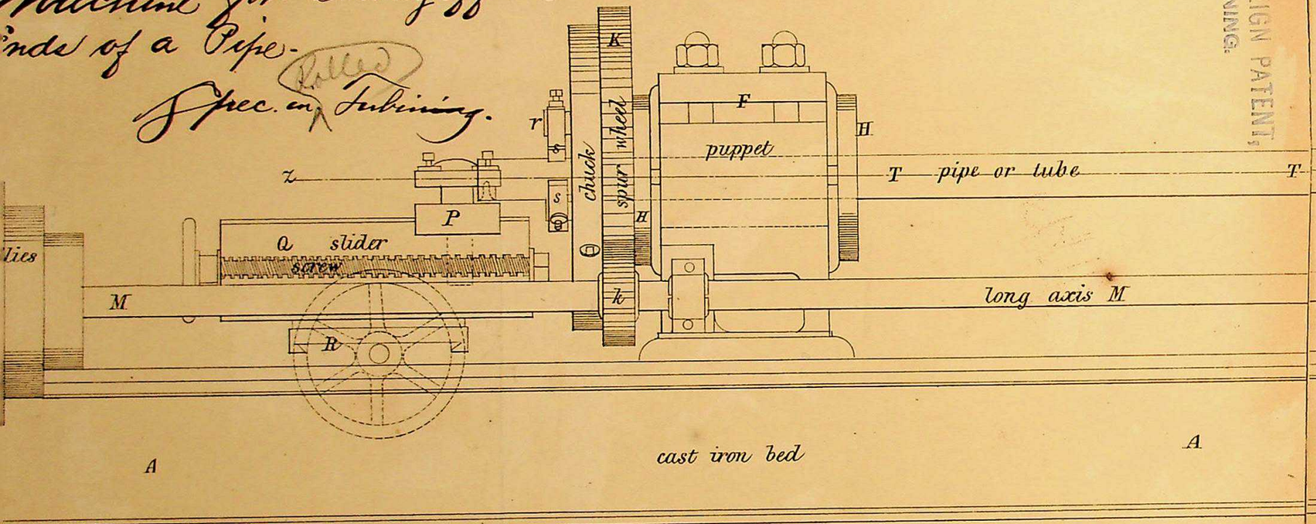
Machine for cutting off the two ends of a Pipe.

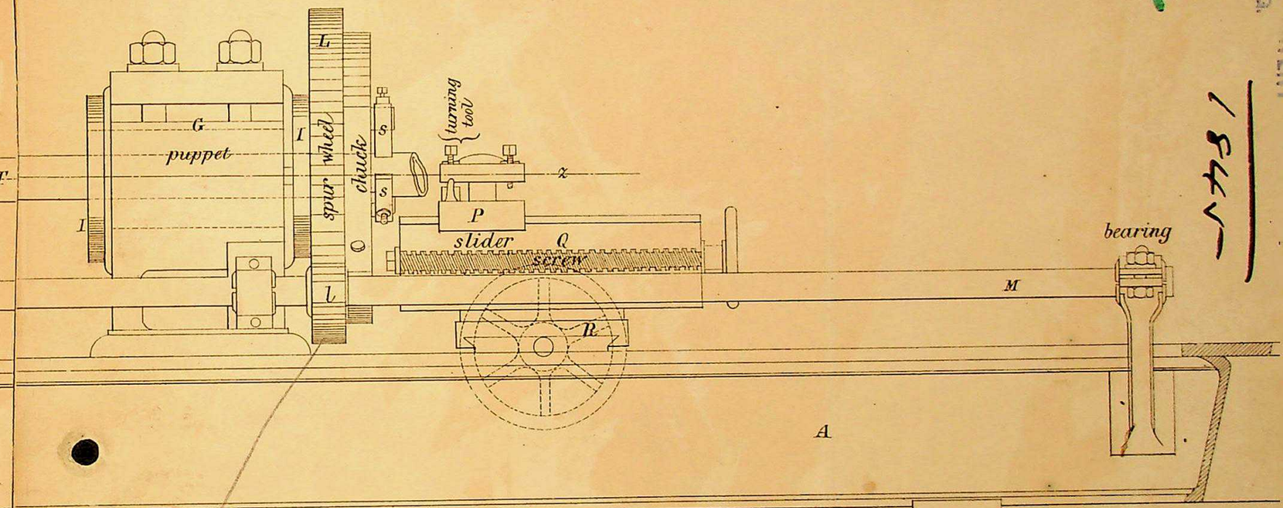
Spec. in Tubing.

82. METAL WORKING, Turning &c. &c.

82. TURNING. FOREIGN PATENTS.

FIGURE. 2. *Elevation of the back of the machine*





Grant Kerr & have inside chucks

k & l are adjustable on M

1845

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PHOTOGRAPHS
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Dept. Copy

1845
101
484 METAL WORKING. XIII.
Rolled Tubing
13

A.D. 1845 . . . . . N° 10,546.

Manufacture of Pipes and Tubes.

SELBY'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, GEORGE SELBY, of Cambridge Street, Birmingham, in the County of Warwick, Tube Manufacturer, send greeting.

WHEREAS I did, by Petition, humbly represent unto Her present most Excellent Majesty Queen Victoria, that I had invented "CERTAIN IMPROVEMENTS IN THE MANUFACTURE OF PIPES OR TUBES OF THAT CLASS OR KIND WHICH ARE FORMED BY WELDING SKELPS OF WROUGHT IRON;" and Her said Majesty being willing to give encouragement to all arts and inventions which may be for the public good, was graciously pleased, by Her Royal Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Eighth day of March, (One thousand eight hundred and forty-five,) in the eighth year of Her reign, for Herself, Her heirs and successors, to give and grant unto me, the said George Selby, my executors, administrators, and assigns, Her especial licence, full power, sole privilege and authority, that I or they, by myself or themselves, or by my or their deputies, servants or agents, or such others as I or they should agree with, and no others, during the term of fourteen years from the date of the said Letters Patent, should and lawfully might make, use, exercise and vend my said Invention within that part of Her said Majesty's Dominions called England, Her Dominion of Wales, and Town of Berwick-upon-Tweed, in such manner as to me, my executors, administrators, and assigns, shall seem meet, and as

that I or they shall enjoy the whole profit and advantage arising by reason of the said Invention during the said term of fourteen years; and for that end Her said Majesty requires and strictly commands all Her subjects whatsoever, within England, Wales, and Berwick-upon-Tweed aforesaid, that they shall not, neither directly nor indirectly, make, use, or put in practice my said Invention, or any part thereof, nor in anywise counterfeit, imitate, or resemble the same, nor make any addition thereto or subtraction therefrom, whereby to pretend himself or themselves to be the inventor or inventors thereof. And whereas the said Letters Patent contain a proviso obliging me, the said George Selby, particularly to describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, and to cause the same to be enrolled in Her Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said Letters Patent, as in and by the same, (reference being thereunto had), will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said George Selby, do hereby declare that the nature of my said Invention is described and ascertained in manner following, and by the aid of the five Sheets of Drawings hereunto annexed, that is to say:—

Part of my said Improvements in the Manufacture of Pipes or Tubes of that Class or Kind which are formed by Welding Skelps of Wrought Iron, relates to the preparation of such skelps by turning up the same (as it is commonly called) into the form of a tube, with the edges of the iron meeting (or nearly so), in preparation for the welding of those edges together to form a pipe or tube; for the skelps of wrought iron are long narrow slips of flat iron formed by rolling the iron between a pair of revolving rollers to a uniform thickness and breadth, the said breadth of the skelp being such as will suit the circumference of the intended pipe or tube, when the skelp is turned up into the form of a tube. The turning up has been performed in various ways, such as by hand hammering the skelp (when heated red hot), over a grooved anvil and a mandril, or by a machine called a crocodile, which bites the skelp laterally between grooved jaws, which open and shut without any mandril being used, or by drawing the skelp through a bell-mouthed hole by a machine called a drawbench, sometimes without a mandril, at other time with a mandril. And it has been proposed to perform the turning up by passing the skelp through between revolving grooved rollers, in some cases with a mandril, in other cases without. In all these cases the iron of the skelp is heated red hot, and is turned up in that state. But none of the said modes have been so

complete as is desirable for want of precision in the turning up; and, commonly, (when no mandril is used), the skelps are not turned up to a truly cylindrical form, the section not being circular, but more in the shape of a pear, owing to the two edges of the skelp not being bended to the proper curvature for the circular form which is required; and although, when the turning up is performed around a mandril, a tolerably circular form of section may be given to the skelp; that is usually done by drawing the skelp through a bell-mouthed hole by a drawbench with a mandril held stationary within such hole, and in such case the strain of so drawing the skelp by a drawbench when in a red hot state is injurious to the iron, and stretches the edges thereof.

Sheet I. of the Drawings hereunto annexed represents machinery for turning up skelps. According to this part of my improvements, Figure 1 is a side elevation; Figure 2 an end elevation at the end where the iron of the skelp is introduced in its flat state, and red hot from a furnace, into the machinery; and Figure 3 a like elevation at the opposite end where the skelp comes through in a turned-up state; and Figure 4 is a horizontal plan. The same letters of reference are used to denote the same parts in all the Figures. A and B are a pair of revolving rollers disposed one above the other in a suitable framing, and turned round by the machinery in a suitable manner for the iron skelp I to be passed through between them when the iron is in a flat state and red hot, the said rollers being for that purpose placed near to a furnace so as to be opposite to the door thereof, as is shewn in the plan, Figure 4, in order that the long flat skelp of iron I, when it has become heated to a proper red heat in the furnace, may be drawn out endways at the door of the furnace by a workman with a pair of tongs, and the end presented between the revolving rollers A and B, which by their motion will draw in the heated iron I, and pass it through between them, turning up the two edges of the skelp I to portions of the circular form that the whole skelp is afterwards to be turned up to, but leaving the middle part of the iron skelp flat as it came out of the furnace. And as the iron I is carried onwards by the motion communicated to it by the revolving rollers A, B, it passes between two fixed guiding cherks D, E, which checks, by acting against those two edges of the skelp I which have been already partly turned up as aforesaid, cause those edges to be gathered one towards the other sufficiently for the iron I to be taken in between a second pair of revolving grooved rollers L, M, which complete the said gathering together of the edges and the turning up of the iron to its intended circular form with the edges meeting or slightly overlapping, and a stationary mandril F applied in the space between the grooved rollers L, M, so that it will be within the interior hollow of the iron I whilst the same is in the

act of passing through between those rollers, and in the act of being by their action turned up completely as aforesaid. The said stationary mandril F is a round plug or piston at the end of a long horizontal stem *f*, which is supported at its extreme end by a fixed rest, so as to keep the whole mandril stationary, and prevent it from being carried endways by the motion of the iron I over it. The said stem *f* of the mandril is longer than the whole skelp I which is to be turned up, and the skelp slides along over the stem *f*, when the skelp I is protruded through from between the rollers L, M, by the revolving motion thereof. The rapidity of the motion of the acting circumferences of the two rollers L, M, is the same as that of the other rollers A, B, because both pairs of rollers are turned round equally fast by means of connecting wheel work as follows:—G is a spur cog wheel on a horizontal axis *g*, which axis *g* is turned round by any suitable connexion from millwork actuated by a steam engine or other prime moving power; or otherwise the teeth of the spur wheel G may be engaged by the teeth of a similar spur wheel which belongs to such millwork, so as to turn the wheel G and its axis *g*; and the said spur wheel G, by its teeth, turns another similar and equal spur wheel H, which is fastened upon the axis *h*, *h*, of the lowermost roller B, and on the same axis *h* a spur wheel K is fastened, and turns another similar and equal spur wheel J, which is fastened on the axis *b*, *b*, of the uppermost roller A; also on the extreme end of the first-mentioned axis *g* a mitre bevel wheel *o*, Figure 3, is fastened, and turns a similar and equal mitre bevil wheel P, which is fastened on the upright axis *l* of the roller L, and on the lower end of that axis *l* is a spur wheel Q, which turns another similar and equal spur wheel R on the upright axis *m* of the other roller M. And whereas the spur wheels G and H are a pair of equal size and number of teeth, and also the bevil mitre wheels O and P are a like pair, it follows that the horizontal axis *h*, *h*, with the lowermost roller B thereon, will be turned round with the same rapidity as the upright axis *l*, with the roller L thereon, is turned round; also, owing to the equality of the pair of spur wheels K and J, the uppermost roller A will be turned round with the same rapidity as the lowermost roller B; and by the equality of the pair of spur wheels Q and R, the two rollers L and M will be turned with the same rapidity one as the other; so that in fact all the four rollers A, B, and L, M, are turned round with equal rapidity; and the operating parts of all those rollers being of the same diameter, their acting circumferences, with which the heated iron comes in contact, will move with the same speed for propelling the heated iron of the skelp through between those circumferences, and therefore the second pair of rollers L, M, will take the iron I in between them as fast as the first pair A, B, delivers it out

to them. W, W, W, W, represents the fixed framing of the machinery, and is distinguished by being shaded with Indian ink. The bearing brasses for the axis *h*, *h*, of the lowermost roller B, and for the axis *b*, *b*, of the uppermost roller A, are fitted one above the other into upright grooves in the fixed framing W, W, and the said brasses are kept in place in those grooves by means of caps fastened over the grooves and screws *v*, *v*, passing vertically through those caps, and by those screws *v*, *v*, the bearing brasses for the axis *b*, *b*, of the uppermost roller A, can be adjusted so as to keep the circumference of that roller at a proper distance from the circumference of the lower roller B, in order to leave an open space between the said two circumferences suitable to the thickness of the iron of the skelp I, which is to be passed through between those circumferences; but it is not intended to compress the iron between them more than is necessary for obtaining as much adhesion as will cause the iron to be propelled through between the rollers A, B, by the revolving motion thereof. The form of the said open space which is left between the said two circumferences is represented in Figure 2, being colored red therein at I, to represent the section of the red hot iron, and the form into which the two edges thereof will be turned up (as already mentioned) by passing through between the two rollers A, B, viz., the two edges of the iron I are turned up to portions of the same circular curve that the whole of the iron I is afterwards to be turned up to by the succeeding operation of the other pair of rollers L, M. The said two portions of the circular curve are each one-fourth part of the whole circumference of the circle, and consequently one-fourth part of the whole breadth of the iron I at each edge of that breadth is turned up in forming those said portions, leaving one-half of the said whole breadth in the middle of that breadth flat and unaltered by having passed through between the rollers A, B. The surface of the uppermost roller A is partly of a cylindrical form, the length *x*, *x*, Figure 2, of the cylindrical part (in a direction parallel to the axis *b*, *b*, of the roller A,) being equal to half the circumference of the circle which the interior of the skelp will assume after being completely turned up in passing between the other pair of rollers L, M. The mandrel F, Figures 1 and 4, is a circle of that size, and the two ends of the roller A beyond the said cylindrical part *a*, *a*, are rounded off, as shewn in Figures 2 and 4, to the convexity of quarters of the said circumference of the said circle. And in like manner the surface of the lowermost roller B is partly of a cylindrical form, the length *y*, *y*, Figure 2, of the cylindrical part being equal to half the circumference of the circle which the exterior of the skelp will assume after being completely turned up in passing between the other pair of rollers L, M.

The aperture or space left between the grooves of the two rollers L, M, see Figure 3, is a circle of that size, and the two ends of the roller B, beyond the said cylindrical part *y*, *y*, are prominent borders rounded to the concavity of quarters of the circumference of the said circle. The two grooves around the circumferences of the second pair of rollers L, M, are formed to the concavity of halves of the circumference of the said circle which the exterior of the skelp will assume after being completely turned up in passing between the rollers L, M. And in order that the end of the iron skelp I may be qualified for entering properly between the two rollers A, B, in the first instance, when it is drawn out of the furnace in a red hot state, as already mentioned, that end of the iron should be prepared before it is put into the furnace by turning up its two edges by hand hammering over a suitable block or anvil when red hot, so as to give that end the exact form shewn at I, Figure 2, for two or three inches in length at the extreme end of the iron skelp. The portions so turned up should bend with easy slopes from close parts of the edges farther along from the end which are not turned up at all, but which remain flat, as is shewn in the Plan, Figure 4. The end of the iron so prepared will be suited for being taken in between the rollers A, B, in a proper manner. And in order to ensure that the iron I shall be presented to those rollers in a straight direction, lateral guides may be fixed to the framing W, W, as at *z*, *z*, Figure 4, which will present upright sides to the edges of the iron I, so as to keep the same in the proper intended line as it comes out of the furnace, and enters between the rollers A, B. And in order to keep the edges of the iron I correct when passing between the two rollers A and B, the uppermost roller A has a border upon each end of it at O, O, which border will meet and guide the two edges of the iron when they are turned up, as shewn at I, Figure 4, in passing between the rollers. And note, there are two kinds of welded joints in use for uniting the edges of the skelps of wrought iron, in order to form tubes or pipes; viz^{t}, one called jump joints, or butt joints, or edge-to-edge joints, in which case the edges of the iron skelp are square to the flat surfaces of the skelp, and merely meet edge to edge after being turned up into the form of a tube, and the meeting edges are welded together without any overlapping of the edges; and the other called lapped joints or scarf joints, in which case one edge of the iron overlaps upon the other edge thereof, and the overlapping edges are welded together. The edges of the iron skelp for such last-mentioned joints are prepared by bevelling or thinning away both edges to what are called feather edges, which when overlapped by the turning up, so as to be ready for being welded together at the overlapping parts, the said edges will correspond one bevil to the other, so as to make no greater (or very little

greater) thickness of metal at the welded joint of the pipe or tube than at other parts of the circumference of the pipe or tube. For making common qualities of welded iron tubes, such as are to be used for gas and water under slight pressures, the edges of the iron skelps may be (and usually are) formed at the same operation of rolling between revolving rollers, whereby the iron for the skelps is manufactured, whether those edges are to be square for making edge-to-edge welded joints, or whether they are to be feather edges for making lapped joints. But for making the better qualities of welded iron tubes, such as are to be used for steam and hot water under strong pressures, which tubes require great strength, and particularly tubes for the internal flues in steam boilers, which require to be made of thin metal, and of the greatest possible strength and tightness that such thin metal can give (and particularly so at the welded joints), the two edges of the iron skelps are first cut and dressed straight and true, so as to remove the outside metal from those edges, and obtain clean surfaces of the solid iron for welding together, and this dressing is sometimes done for the edges of skelps, which are to be square for welding with edge to edge joints, but more particularly for edges of skelps which are to be feather-edged for welding with lapped joints. Such cutting or dressing is usually performed by drawing the iron of the skelp when it is in the flat state and cold through between two suitable fixed cutters by power of a drawbench, so as to pare off a shaving of iron from both edges at the same time, and this is done before the skelps are turned up. The mode of turning up iron skelps by the machinery, Sheet I., as herein-before explained, has reference chiefly to the turning up of square-edged iron skelps in preparation for being welded with edge to edge joints; but in case of turning up feather-edged iron skelps by the same machinery, Sheet I., the operation will be the same as already explained, except as to the two border edges *o*, *o*, at the ends of the uppermost roller A, which must be formed to suit the respective bevels of the two feather edges; and also the two lateral fixed guides at *z*, *z*, Figure 4, if used as herein-before described, would be liable to injure the feather edges if they touched such feather edges, and therefore such guides as *z*, *z*, should not be used, but more care must be taken to place the iron skelp with its lengthway straight in the furnace in the true direction for entering and passing straight through between the rollers A and B; also the preparatory turning up of the foremost end of the iron to the form shewn at I, in Figure 2, must be very correctly performed by means of a true moulding block or anvil, and that end must be correctly inserted between the rollers A and B, and those rollers, together with all the machinery, Sheet I., may be left motionless until the said end of

the iron I has been drawn out of the furnace, and duly and correctly presented to the space between the rollers A, B, as at I, Figure 2, and after it is seen that the said end is properly placed for entering correctly, then the machinery, and consequently the rollers A, B, may be set in motion, which can be done by any usual means of connecting and disconnecting with the millwork by which the machinery is actuated, either by some such means of connecting and disconnecting with the axis *g*, or else with the spur wheel G thereon, as herein-before described, or else in any other way as may be most convenient. And further, in case of so turning up feather-edged skelps as aforesaid that edge thereof which is to be outermost in the overlapping, and the other edge which is to be innermost in the overlapping, must be kept securely in their respective positions of outermost and innermost at the moment when the two edges are approaching towards each other during the passage of the red-hot iron from the first pair of revolving rollers A, B, to the second pair L, M, that is to say, after having had its two edges turned up by passing through between the first pair A, B, and before entering between the other pair L, M, by which the turning up is to be completed. For this purpose, one of the fixed guiding cheeks D, E, (as, for instance, that which is marked D,) must be set in such a position as to gather in that edge of the skelp upon which it operates somewhat further inwards than the other; such cheek E will at the same time gather in the other edge of the same skelp, so as that the first-mentioned edge may become the innermost, and the last-mentioned the outermost, of the overlapping edges. And in order to further ensure that the two edges shall be so disposed, and shall not be deranged from such intended relative positions, as, for instance, by action of any scale or dirt which may be carried along with the iron from the furnace, and get accidentally interposed between either of the said guiding cheeks D, E, and the turned-up edge of the iron which is to be acted upon by that cheek, there is a piece of steel blade X, Figure 4, fixed upon the fixed guiding cheek D, and turning downwards in an inclining position so as to reach in between the two approaching edges with its end over the innermost and under the outermost of the overlapping edges, and the said end of the fixed blade X being so interposed will prevent the edges being brought prematurely in contact until after the two turned-up sides of the skelp have been so far approached, one towards the other, as that the outermost of the overlapping edges will be brought properly over the innermost, and therefore as the iron passes onwards between the second pair of rollers L, M, they will, in completing the turning up, do so with the two edges properly overlapped in their intended relative positions. And as the stationary mandril F is within the red-hot iron at the moment when it is passing between

the rollers L, M, and receiving their pressure for completing the turning up, that mandril sustains the innermost edge or any other part of the iron from being pressed further inwards than its proper place; or if that edge (or any other part of the iron) should have been so pressed further inwards, the mandril will restore such edge or part to its proper place, so as to render the turned-up skelp a correct cylindrical form, the same as the pipe or tube is to be after the edges have been welded, so that the subsequent operation of welding will be merely welding, and not a completion of the form and welding also, as is the case when the skelps are not turned up to a correct cylindrical form, but are left of a pear-shaped section, as herein-before mentioned. But, nevertheless, the machinery, Sheet 1, may be used for turning up skelps to a pear-shaped section, if that is preferred, as it may be in some cases herein-after to be mentioned. The rollers A, B, and L, M, and the mandril F, must be changed for others when skelps of a different size are to be turned up in the machinery, Sheet 1. But for skelps of a different thickness of metal, which are nevertheless to be turned up to the same diameter of cylindrical form externally, it will only be requisite to change the uppermost roller A and the mandril F for others suitable to the size to which the interior of the skelp is to be turned. The bearings for the axis *b*, *b*, of the uppermost roller A, must be kept suspended by the setting screws *v*, *v*, in order that the roller A cannot descend by its own weight upon the lower roller B, so as to close the opening I, Figure 2, that is intended to be left between the two rollers for introducing the iron. And note, the axes *l* and *m* of the second pair of rollers L, M, are disposed in a vertical position, with the said rollers L, M, fastened on the uppermost ends of the said axes, in order that the rollers may be more easily changed for others without disturbing the axes. The furnace may be of the same kind as is commonly used for heating skelps red hot, in preparation for turning them up. And note, it is not new to employ grooved rollers for turning up skelps or partly turning up skelps, nor the application of a stationary mandril, such as F, to be withinside of the iron of the skelp at the moment whilst it is in the act of being completely turned up to a cylindrical form by passing through between a pair of grooved rollers; neither is it a new proposal to partially turn up the iron of a skelp from its flat form, by action of a convex roller within a concave trough or gutter, along which the iron is drawn horizontally by power of a draw bench, whilst the said roller presses the middle part of the breadth of the iron skelp down into the concave form of the trough or gutter, but without acting at all upon the edges of the skelp, and also in passing onwards after receiving that concave bending down of its middle part, and turning of the two edges upwards like a gutter, the iron

then passes between a pair of grooved rollers, by which the edges of the skelp are to be turned inwards and bended downwards over and around a fixed mandril, which is held motionless between the said rollers and within the iron; and also the iron, in passing still further onwards, passes through a bell-mouthed hole in a solid piece of iron or wirtle for completing the turning up to a cylindrical form. The machinery in Sheet I. differs from such plan, not only in the circumstance of the iron being propelled and carried forwards through between the two pairs of rollers by the revolving motion which is given to them by the power of millwork, instead of the iron being drawn through between the rollers by power of a drawbench, and in the use of a concave trough or gutter with one convex roller disposed over the same in place of a pair of rollers, such as A, B, but also differs more particularly in the nature of the first bending of the iron skelp from its flat state, which, as performed by the drawbench drawing the iron along in the concave trough or gutter beneath the concave roller, only presses down and bends the middle part of the breadth of the iron to a portion of the circular form that the whole skelp is afterwards to be turned up to, but leaving the two edges of the breadth of the skelp without being bended from their previous flatness, although those unbended edges are turned upwards like the upright sides of a gutter, whereof the bottom is a semicylindrical concave curve, or nearly such, which is a form of preparatory bending of the iron that is quite unfavorable to the subsequent complete turning up of the iron of the skelp between a pair of grooved rollers around a stationary mandril to a cylindrical form of turned-up skelp; whereas, according to this part of my improvements, the first bending of the iron of the skelp from its flat state, as performed between the pair of rollers A, B, only causes the two edges of the breadth of the skelp to be turned up to portions of the circular form that the whole of that breadth is afterwards to be turned up to, but leaves the middle part of the breadth of the skelp flat, so that the iron will (by action of the pair of rollers A, B,) be bended into the form of a trough or gutter with a flat bottom, having two rounded angles and sides rising from that flat bottom, which is a form of preparatory bending of the iron that is most favorable for the subsequent complete turning up of the iron of the skelp between a pair of grooved rollers, and around a stationary mandril, to a cylindrical form of turned up skelp, instead of the iron being bended (by action of a concave roller, and concave trough or gutter,) into the form of a trough, having a semicircular or nearly semicircular bottom with two upright sides rising from it. And note, in order to prevent the end of the red-hot iron from adhering in the groove of the lowermost roller B, a fixed rest should be applied behind that roller, so

as to be in contact with the revolving surface thereof in the manner of a scraper, at a part of the circumference as near as can conveniently be to the upper part or summit of that circumference, and towards the uppermost roller A, in order that such fixed rest may sustain the iron as it is coming out from between the rollers A, B, so as to sustain the flat under side of the iron, and keep it up in its proper horizontal position whilst it is passing onwards towards and between the two guiding cheeks D and E, after having passed through between the rollers A and B.

And another second part of my said improvements in the manufacture of pipes or tubes relates to certain machinery already in use for such manufacture, and which operates by means of four revolving grooved rollers, which are so combined as that when a turned-up skelp of iron of which a pipe or tube is to be formed is passed at a welding heat through between the said four revolving grooved rollers, they will operate simultaneously on four sides or portions of the circumference of the pipe or tube with a tendency to press the iron inwards towards the central line of the pipe or tube, and around a stationary mandril, which may be held withinside of the iron whilst it is so passing through between the said four rollers. And whereas the said machinery was the subject of Letters Patent granted to Mr. Richard Prosser on or about the Twenty-seventh day of March, One thousand eight hundred and forty, and the same is fully described in his Specification, which was enrolled in Chancery on or about the Twenty-sixth day of September, One thousand eight hundred and forty, it is unnecessary to enter into a more minute description thereof. But this second part of my said improvements is the application to such machinery of an apparatus now about to be described, for scraping away and removing all excess of scoria or laytor, or scale or dirt, which may be adhering to the exterior surface of the heated iron when the same is just withdrawn from the furnace, and is about to be passed through between the said four revolving grooved rollers, the said apparatus consisting principally of four steel scrapers, which are so combined together as that they will amongst the four encompas all around the exterior circumference of the heated iron of which a pipe or tube is to be formed, and the said four combined scrapers are so applied in the machinery as that they will operate for removing the excess of scoria or dirt from the surface of the heated iron at a part thereof which is just about to enter in between the four revolving grooved rollers of the machinery, in order to be compressed and welded thereby, wherefore the scoria or dirt upon the surface of the heated iron will be subjected to the action of the said four combined scrapers immediately previous to the said iron being subjected to the action of the four combined rollers, and all excess of scoria

or dirt will be removed by action of the said scrapers from the surface of the heated iron, so as to avoid pressing such excess of scoria or dirt into the said surface by the action of the said rollers. Sheet II. contains representations of this part of my said improvements, Figure 1 being a front elevation of the part at which the heated iron is introduced from the furnace into the machinery, and Figure 2 a longitudinal section, the same letters of reference being used in both to denote the same parts. E, F, are two revolving grooved rollers, one being above the other in the same vertical plane. They are mounted on two horizontal axes A and B, Figure 2, and turned round by the power of millwork. I, J, Figure 1, are two other revolving grooved rollers, exactly the same as E, F, but disposed side by side in the same horizontal plane, being mounted on two vertical axes (not represented), but those axes, and the two axes A, B, are all four in the same vertical plane, and the circumferences of the said four revolving grooved rollers are all formed to meet together with corresponding mitre bevils which come into contact one with another, and the concave grooves in all the four rollers correspond one to another, so as to leave between the four a circular aperture, to which one end of the heated iron skelp is to be presented as it is drawn out of the furnace, and it will be taken in and propelled through the said aperture by the revolving motion of the four rollers, which will by their combined action compress the heated iron on all four sides of its circumference at the same time, viz., the roller F will press the upper side, and the roller E the lower side, the roller I the right-hand side, and the roller J the left-hand side. The lines W, W, Figure 1, denote part of the outline of the large massive frame wherein the several bearings for the axes of all the four revolving grooved rollers E, F, I, J, are sustained in their relative places; and a section of the same frame is shewn at W, W, Figure 2. The toothed wheelwork for giving simultaneous revolving motion to the four rollers is not represented, being the same as described in Mr. Prosser's said Specification. *r* is the stationary mandril, which is a plug or piston applied within the aforesaid aperture between the four revolving grooved rollers, so as to be within the heated iron, when the same is passing through the said aperture between the said rollers, and when the said iron is receiving its compressure from them the said mandril *r* being maintained motionless by means of its long stem R, R, which is longer than the length of the pipe or tube intended to be made, but it is represented broken in Figure 2. The extreme end of the stem R is lodged in a suitable support *s* at the upper end of a fixed standard S. The end *r* of the mandril is a bulb, or plug, or piston, very nearly the size that the interior of the pipe or tube is intended to be, and which piston, by occupying that interior, keeps the heated iron from being pressed in by the

action of the four revolving grooved roller, so as to encroach upon that interior. As the mandril is kept motionless whilst the heated iron is propelled over it, the iron causes the stem R, R, of the mandril to be urged endways with a considerable force, but which force is resisted, and the mandril held motionless by the support *s*. The pipe or tube when it comes out through between the four revolving grooved rollers slides along over the stationary stem R, R, of the mandril, which is dismounted from its said support *s* as soon as all the length of the newly-formed tube has come through, and the same is then drawn off from the long stem R, R, of the mandril, which is then put into water contained in a long trough, (whereof a portion of one end is shewn in Figure 2), in order that the mandril may become cooled in readiness for being used again. And in order to guide the end of the heated iron properly into the aforesaid aperture between the four revolving grooved rollers, a conical mouthpiece or trumpet-mouthed tube Y, Y, is fixed in front of the machinery, the horizontal central line of the said conical mouthpiece being a continuation of the horizontal central line of the said aperture between the said rollers, and of the long stem R, R, of the mandril, which central line is marked Z, Z, Figure 2. The said conical mouthpiece Y, Y, is formed (or is fixed) in the centre of a large shield or plate V, V, which is fixed vertically by four bolts and nuts in front of the frame W, W, of the machinery; and when the heated iron skelp is drawn out of the adjacent furnace by a workman with a pair of tongs, the foremost end of the iron being moved endways, or rather thrown with a rapid endway motion into the large end of the conical mouthpiece Y, Y, then, in passing through the said mouthpiece, and out at the small end thereof, the said foremost end of the heated iron cannot fail to find its way properly into the aperture between the four revolving grooved rollers, and over the pointed end of the bulb or piston *r* of the mandril which is lodged within the said aperture. And thus far the aforesaid description of Sheet II. contains no part of my said improvements, but is machinery well known and in extensive use under Mr. Prosser's said Patent. The four scrapers herein-before mentioned as being applied according to this part of my said improvements to the said machinery are marked 1, 1, and 2, 2, Figure 2, and are mounted upon centres of motion, 5, 5, around the conical mouthpiece Y, Y, which is suitably formed for receiving them, as is more clearly shewn in Figure 3, which is a horizontal plan of the shield V, V, and mouthpiece Y, Y, detached from the machinery. In Figures 1 and 2 the same parts are shewn in their places in the machinery. The shield V, V, is a square plate of cast iron, having the conical mouthpiece Y, Y, formed in the same piece with it, and around the outside of the conical tube of such mouthpiece there are four prominences, in which grooves are formed

for the reception of the stems of the four scrapers 1, 1, 3, 3, 4, 4, Figure 3, and those stems are retained in place in the said grooves by means of centre pins 5, 5, which are inserted crossways through the sides of the grooves and through the stems of the scrapers, so as that the said stems are moveable about those pins 5 for their centres of motion before mentioned, in order that the scrapers themselves, which are formed on the ends of the said stems, may be all four mutually approached towards the heated iron or mutually withdrawn therefrom by motions of the stems of all the four scrapers about their said centres of motion 5 respectively. The said stems are retained laterally in due place by being fitted correctly into their aforesaid grooves around the outside of the conical mouthpiece. The scrapers are formed on the backmost ends of their stems, and those stems reach backwards towards the aperture between the four revolving grooved rollers, as far as they can go into the space left between the circumferences of the four rollers without touching the rollers, as is shewn in Figure 2. The aforesaid grooves in the prominences around the conical tube Y, Y, of the mouthpiece, do not reach so far backwards, but the stems reach back beyond the ends of their grooves within which the stems are lodged. And note, their are projecting shoulders on each of the stems near to the ends of the said grooves, as is shewn in the Figures, in order to prevent scoria and dirt being thrown into the grooves between the stems and their fittings against the insides of those grooves. In Figure 4, one of the scrapers and its stem is shewn detached for more complete explanation. The scrapers themselves, at the ends of the stems, are each formed with a concave scraping edge, which is conformable to a portion of a circle of very nearly the same size as the aperture between the four revolving rollers, and consequently of the same size as the exterior of the pipe or tube which is to be welded by being passed through that aperture. The said concave scraping edge of each scraper comprises rather more than one-fourth of the circumference of the said circle, and the stems of the scrapers are of different lengths from their respective centres of motion 5, so that those scrapers which are adjacent one to another around the exterior circumference of the heated iron of the pipe or tube will be one of them so much farther backwards towards the rollers than the next scraper adjacent to it as to avoid interference of one scraper with another, although each one applies somewhat farther round the exterior circumference of the pipe or tube than one-fourth of that circumference, in order that there may be no part of the exterior circumference of heated iron which can escape the scraping action of one or other of the four scrapers in consequence of any intervals being left between one scraper and the next in the direction around the said circumference, as

would necessarily be the case if the ends of the stems of all the four scrapers were of one length, so that all the four scrapers would act around the heated iron in the same vertical plane; but, as is shewn in Figures 2 and 3, the scraper 1, which is at the uppermost side, and operates upon rather more than the uppermost fourth of the circumference of the heated iron, is not so far backwards towards the rollers as the two side scrapers 3 and 4, Figure 3, which operate each upon rather more than one-fourth of the said circumference, and those two are not so far back as the lowermost scraper 2, Figure 2, (and which is shewn dotted as it would appear beneath the heated iron, in Figure 3), which last-mentioned scraper operates upon rather more than the lowermost fourth of the said circumference. And note, the lowermost scraper 2, and the uppermost scraper 1, might be both at the same distance backwards towards the rollers, provided that the two side scrapers 3 and 4 are at a greater or lesser distance backwards towards the rollers than the said uppermost and lowermost scrapers are backwards, as appears in Figure 3, for the scrapers which are to operate on opposite sides of the circumferences of the pipe or tube may be equally backwards, provided that the scrapers which are to operate on adjacent parts of that circumference are one more backwards towards the rollers than the other. And as to the motions which are to be given to the four scrapers about their respective centres of motion 5, such motions are caused principally by springs applied to the tails or outermost ends of the four stems of the scrapers, as shewn at 6, 6, 6, 6, Figure 1 and 2, so as to pull those tail ends outwards from the central line *z*, *z*, of the conical mouthpiece Y, Y, and of the pipe or tube, whereby, the stems acting as levers about their respective centre pins 5, the scrapers at the other ends of the stems will be forced inwards towards the said central line, so as to bring and keep their scraping edges in contact with the surface of the heated iron whilst it is passing with a rapid motion endways through between the said edges, and thereby the said edges will scrape away all excressences of dirt, scale, or superfluous scoria which the heated iron may have brought with it out of the furnace, and prevent such matters going in between the rollers along with the heated iron, as they would otherwise do; but the said springs will allow the scraping edges to retreat, if necessary, in case of accident, so as to avoid risk of breaking the scraping edges. The springs 6, 6, 6, 6, can only draw the tail ends of the stems of the scrapers outwards to a proper distance for the cutting edges of the scrapers to be approached so near one towards another as that their concave escaping edges will conform to the intended circumference of the pipe or tube, without encroaching upon the circumference, and therefore, although the springs will allow the scraping edges to retreat, as already stated, in case of accident, nevertheless those edges cannot

cut into the heated iron. The springs 6, 6, 6, 6, are such as are used in what are called spring steelyards for weighing. The steel spring is coiled helically in a cylindrical form around a central rod, which is connected with the tail end of the stem, the spring being inclosed in a cylindrical tube or box fixed to the shield V, V. The ends of the stems are guided in their motion by passing through openings cut through the shield. And in order that the end of the heated iron for the pipe or tube may be allowed to enter readily between the scraping edges of the four scrapers when that end is to be presented to the aperture between the four revolving grooved rollers, those edges are opened considerably one from the other by gathering in the tail ends of all their stems towards the central line, in opposition to the force of their springs 6, 6, 6, 6; but as soon as the end of the heated iron has entered between the four rollers, so as to first begin to be drawn forwards by their revolving motion, and has also began to enter over the end *r* of the mandril, then the said tail ends of the stems which had been so gathered in are suddenly released, in order to permit their springs 6, 6, 6, 6, to cause the four scrapers to be suddenly closed inwards together around the circumference of the heated iron which is already entered between the edges of the scrapers, and which edges are thereby brought into contact with the surface of the heated iron, in order to scrape away excressences of dirt or scale or scoria from off that surface, as already explained. The said gathering in of the ends of the stems, in opposition to their springs 6, 6, 6, 6, is performed by moving a handle 10; and the said sudden releasing is performed by moving another handle 11, which latter is loaded with a weight 12, so as to descend suddenly of itself when permitted, and it is so permitted to descend suddenly when the mandril *r*, R, R, is pushed a little endways, at the instant of the first contact of the end of the heated iron, when it begins to pass over the end *r* of the mandril, being the same time when it enters the aperture between the four revolving grooved rollers, for that said first contact of the foremost end of the heated iron with the end *r* of the mandril causes a small endway motion of the stem R, R, of the mandril to take place, with a corresponding action of the extreme end of the stem R against the support *s*, at the very moment of the first commencement of the pressure and force which that support has to resist. And the said small motion so given to the mandril by the said first contact of the heated iron therewith (and which motion is transmitted to the support *s* by the stem of the mandril) is made to permit the weight 12 to descend, and suddenly release the ends of the stems of all the four scrapers, in order to allow their springs 6, 6, 6, 6, to operate for closing in all the four scraping edges at once around the heated iron, for the purpose of beginning to scrape the surface thereof,

as already mentioned. The said handle 10 projects out from a circular ring of brass 14, which is shewn separately at Figure 14, and which ring is placed vertically in front of the machinery, as shewn in Figure 1, the interior of the ring 14 being fitted upon a circular rim which projects from the shield V, V, around the entrance to the conical mouthpiece Y, Y, so that the ring 14 can be turned round about its fitting upon the said rim as its centre of motion, which motion will therefore be concentric with the horizontal central line *z*, *z*, and its handle 10 points to the centre. The tail ends of the four stems of the scrapers pass through four spirally curved grooves 15, 15, 15, 15, Figure 14, which are cut out through the brass ring 14. Two of those grooves 15, 15, are shewn in Figure 1, and the manner in which the four stems pass through the said grooves is shewn in Figure 2; and, owing to the spiral form of the curvature of the said grooves, they will act upon the tail ends of all the four stems at the same time, to press those tail ends in towards the centre of the ring, whenever the handle 10 of the ring is raised upwards, as shewn by dotted lines in Figure 1, so as to turn the ring 14 round, as it were, about its centre of motion, through an extent about one-seventh part of a revolution. And there is another like ring of gun metal 16 (see a separate view, Figure 16), applied close flatways against the former ring 14 in contact therewith, the interior of the ring 16 being fitted upon the same projecting rim of the shield V, V, so as to have the same centre of motion. The aforesaid handle 11 projects out from the ring 16, and the weight 12, which is applied to the end of the handle 11, exerts a constant tendency to turn the ring 16 round. The said gun metal ring 16 has four openings through it, at 17, 17, 17, 17, Figure 16, (whereof two are shewn in Figure 1), for the tail ends of stems of the scrapers to pass through, in the same manner as those ends also pass through the curved grooves in the other ring 14, as already explained, and as is shewn in Figure 2, where both rings can be seen in section, with the tail ends of two of the scrapers 1 and 2 passing through both rings as they stand close together, and in contact one with the other. The said openings 17, 17, 17, 17, in the ring 16, are formed like what are called keyhole notches, their form being apparent in the Figures; and after the handle 10 has been raised upwards, as already explained, and the ends of the four stems have been all pressed inwards towards the centre line *z*, *z*, in opposition to their springs 6, 6, 6, 6, by action of the curved grooves 15, 15, 15, 15, then the handle 11 is also raised a little upwards, together with its weight 12, whereby the gun metal ring 16 is turned round so much about its centre as will cause the ends of the four stems to become included within the innermost parts of the key-hole openings 17, 17, 17, 17,

and then the handle 11, with its weight 12, is kept up in its raised position, as shewn by dotted lines in Figure 1, by a stud pin 18, which projects out from it, and catches into a notch upon the upper end of an upright blade spring 19, which is fixed at its lower end to the floor, and its upper end (when the stud pin 18 is so caught upon it) will sustain the tendency of the weight 12 to descend until the blade spring 19 is pushed forwards, so as to bend it as much as will remove its upper end from contact with the projecting stud 18, and then the weight 12 will bring down the handle 11. The blade 19 is so pushed forward by action of the long horizontal rod 20, which extends from the lower end of the lever 21, Figure 2, the upper end of which is situated behind the support *s*, for the extreme end of the stem K of the mandril *r*. The centre pin of the lever 21 is sustained by the fixed standard S, and there is a small rod 22, jointed to the said upper end of the lever 21, and proceeding horizontally through a hole in the support *s*, in the direction of the lengthway of the stem R of the mandril, with a head upon the end of the rod 22, against which head the end of the stem R of the mandril bears, when it is lodged in its support *s*, ready for a skelp of heated iron to be drawn out of the furnace at a welding heat, and introduced into the aperture between the four revolving grooved rollers. The four scrapers having been previously prepared, as already explained,—viz., by first lifting up the handle 10 to the dotted position, Figure 1, whereby the tail ends of all the four stems are gathered inwards towards the centre, so as to open out the scraping edges of the four scrapers one from another, and then by lifting up the handle 11, and its weight 12, to the dotted position in Figure 1, and catching the stud pin 18 upon the notch at the upper end of the blade-spring stop 19, and then after that putting the handle 10 down again into its position shewn in Figure 1, the parts are prepared,—the scraping edges will in that state be expanded or opened out one from the other, so as to leave an opening between the four scraping edges rather larger than the innermost aperture of the small end of the conical mouth piece Y, Y, through which the end of the heated iron is to pass, that innermost aperture being somewhat larger than the outside diameter of the intended pipe or tube. After such preparation of the parts, when a skelp of iron has become heated to a welding heat in the furnace, the four revolving rollers are set in motion, and one end of the heated iron skelp is drawn out from the furnace by a workman with a pair of tongs, and thrown with a rapid endway motion into the large aperture of the conical mouthpiece Y, Y, and after passing through the innermost small aperture thereof, (and between the four opened scrapers,) the end of the heated iron enters the aperture between the four revolving rollers, which by their motion

begin to draw in the iron, and at the same time the end of the heated iron comes in contact with the end *r* of the mandril, and forces the same a little endways by the pressure which the iron exerts against and around the mandril as soon as ever the iron begins to move through between the rollers, and such small endway motion of the mandril is transmitted by its long stem R, R, to the head of the rod 22, so as to move the rod endways until the shoulder behind the said head comes in contact with the fixed support S, and then, as it can retreat no further, the said head of the rod 22 becomes a firm support for the end of the stem R, R, of the mandril. The said small motion so given to the rod 22 is transmitted by the lever 21 and the long rod 20 to the upright blade-spring stop 19, so as to bend the same forwards sufficiently to remove its upper end from contact with the stud pin 18 of the lever 11, and then the weight 12 descends instantly, and turns round the ring 16 so much as to release all the four ends of the stems from the innermost parts of their key-hole notches in that ring, and thereupon the springs 6, 6, 6, 6, draw all those tail ends suddenly outwards from the centre, as shewn in Figure 1, so as to cause the scraping edges of the four scrapers to collapse and close together around the heated iron, as shewn in Figure 2, so as to come in contact with and encompas the exterior surface thereof all around its circumference, so that the motion wherewith the iron is proceeding endways through the revolving grooved rollers will cause the surface of the heated iron with which the four scrapers are in contact to be acted upon by the four scrapers, so to scrape away all excrepences of dirt, scales, or excess of scoria, which the heated iron may have brought with it out of the furnace, and remove the same so as to prevent them from being carried in between the revolving rollers along with the iron, whereby they would become pressed into the surface of the heated iron, to the injury thereof,—and, owing to the aforesaid mode whereby the four scrapers are brought into action instantaneously upon the end of the heated iron coming in contact with the end *r* of the mandril, only a short portion of the foremost end of the heated iron can escape the said scraping action. Note, the nearness of the approach of the edges of the four scrapers towards the centre of the pipe, by action of the springs 6, 6, 6, 6, can be regulated by setting screws 23, 23, Figures 2 and 3, which are tapped into the fixed cylindrical boxes wherein the springs are lodged, and the ends of the screws 23 stop the ends of the stems of the scrapers from being drawn outwards by action of the springs farther than is intended, as already explained. And note, it has been proposed to apply three moveable dies to machinery, with four revolving grooved rollers combined as aforesaid for scraping the surface of the heated iron, but such dies were to be applied in a vertical

frame behind the said rollers, in order to act upon the surface after it had passed through between the said rollers, and the said dies were to be brought into action by a man moving a handle as soon as the foremost end of the iron should come through between the four revolving rollers, which could not be done with certainty of beginning to act at the proper instant of time. But according to this part of my improvements, four scrapers are applied at the mouthpiece in front of the four revolving grooved rollers, in order to act upon the surface of the heated iron immediately before it has entered between the said rollers, and the said four scrapers are brought into action by their springs at the very instant that the foremost end of the heated iron first comes in contact with the end of the mandril, by action derived from that contact, without any attention from any workmen; also the said scrapers are at the ends of stems mounted around the said mouthpiece on centre pins in the manner of levers, which stems reach into the space between the four revolving rollers towards the aperture between them wherein the heated iron is to be inserted, so as that the scrapers themselves are beyond the end of the mouthpiece nearer to the said aperture than could be the case with three dies mounted in a vertical frame; likewise the scrapers being brought into contact with the heated iron by action of springs they can yield in case of accident; and also the said scrapers can be adjusted by means of setting screws, and likewise each of the scraping edges extends around more than one fourth of the whole circumference of the pipe or tube, so as that no part of that circumference can escape being acted upon by one or other of the scrapers, as would be the case with three dies mounted in a vertical frame, and all three acting in the same vertical plane. The scrapers are represented in Figure 4 as being formed in the same piece with their stems. The scrapers themselves are of steel, which may be welded to the ends of the stems if they are made of iron, or the steel scrapers may be fastened to the ends of the stems by screws or rivetted pins. And note, it is requisite, for the action of the said scrapers to be complete and satisfactory, that the skelps of iron which are to be welded into pipes or tubes in the aforesaid machinery with four combined revolving grooved rollers, to which such scrapers are to be applied and used (according to this part of my said improvements) should have been previously turned up to a correct cylindrical form, and not merely turned up to a pear-shaped section as is often practiced, and in which case the said scrapers would not be applicable, unless the scraping edges were to be formed to suit such pear-shaped section, or unless one of the four scrapers were to be removed, the prominent side of the pear-shape of the skelp being in such cases put into the mouthpiece Y, Y, towards the place of the scraper, which is formed to suit the said prominent

side, or of that scraper which is removed. But whereas for thin tubes of the best quality they are often passed through a second time between the four revolving grooved rollers at a welding heat, after having been welded once by passing when in the state of turned up skelps through between such rollers, and at such second time of passing for such rewelding of the pipes or tubes, they will be of a correctly cylindrical form, and therefore the four scrapers will in that case be applicable with full advantage. When skelps are turned up to a truly cylindrical form (as may be done by the machinery Sheet I., then the said four scrapers will be applicable for the first time of passing such skelps through between the four revolving ground rollers for the purpose of welding the edges of such skelps.

And another third part of my said improvements consists in the application to machinery with four combined revolving grooved rollers (of the kind hereinbefore referred to) of four fixed cutters at the back or behind such rollers, and suitably disposed and combined for removing projecting fins from the surface of the heated iron pipes or tubes which are passing through between the said four rollers for the purpose of being welded, the cutting edges of the said four fixed cutters acting upon the heated iron, in consequence of the motion wherewith the same is propelled through and comes out from between the said rollers. The said fins are thin edges of iron, which sometime project out laterally and edgeways outwards from parts of the exterior surfaces of pipes or tubes, which are welded between four combined revolving grooved rollers, owing to the iron of the skelps being of unequal width, so as to occasion an unusual compression of the heated iron at the wide places in passing through between the four rollers, and which are thereby so much separated or forced asunder from the usual and proper contact of their mitre bevil circumferences as to allow a small portion of the soft heated iron to squeeze itself outwards from the iron of the pipe or tube between the said circumferences, and the iron so squeezed out forms the thin projecting edges which are called fins, in consequence of their resemblence to the manner in which the thin fins of some kind of fishes project out laterally from the bodies of such fishes. When such fins have been so formed they require to be removed by some subsequent operation; but according to this part of my improvements they are to be removed immediately after being formed between the said four rollers, and whilst the heated iron is coming out from between them in its soft state.

In Sheet II., at Figures 2, 5, and 6, the said four cutters, with their accessary parts, are represented, Figure 2 being the same longitudinal section already described as to other parts thereof. Two of the four cutters are marked 30 and 31 in Figure 2, where the other two cannot be seen. They

are shewn detached in Figure 6, and all the four are shewn at 30, 31, 32, and 33, in Figure 5, which is an elevation (drawn to a smaller scale) of the new parts, which are fixed at the back of the machinery behind the four rollers, for sustaining the four cutters in their intended positions. The said cutters are strong stems of iron or steel having cutting edges of steel at their extremities, and formed into flat palms at their other ends, for applying to and fastening by screw bolts 36, 36, against the vertical surface of a circular plate 35 of cast iron, which has a hole through the centre of it, and is firmly fixed by means of four curved arms 34, 34, which radiate out from it in the manner shewn in Figures 5 and 2, so that the ends of those curved arms will apply with flat palms to suitable vertical surfaces on the massive frame W, W, and are firmly united thereto by two strong bolts in each palm, so as to hold the circular plate 35 securely in a vertical plane at a small distance behind the four rollers E, F, and with the central hole of the plate 35 concentric with the horizontal central line *z*, *z*, Figure 1. The four cutters are fixed with their stems in conveying directions around the said central line, so that the palms at the end of those stems will be far enough from that line for obtaining firm fastening by the screw bolts 36, 36, to the flat vertical surface of the plate 35 around the central hole therein, as is shewn in Figures 5 and 2; and owing to the convergency of the four stems they reach inwards into the spaces between the four rollers, so that the cutting edges at the other ends of the stems approach quite close to the intended cylindrical surface of the pipe or tube, and also near to the circumferences of the mitre bevil edges of the rollers, and not far from the places where those circumferences are in contact one with another. The ends of the cutters are formed to allow them to enter into the said spaces between the rollers, but without touching the circumferences thereof, and those ends are ground to cutting edges, which apply to the circumference of the intended external cylindrical form of the pipe or tube, so as to present those cutting edges across the lengthway of the pipe or tube in a suitable manner for cutting away any thin fins of iron which may project out from the surface of the heated iron beyond the said intended cylindrical form of the pipe or tube. Those sides of the said cutting edges which are adjacent to the pipe or tube should conform to the cylindrical or circular curvature of the surface thereof, but only the middle part of each cutting edge which so conforms should be sharpened so as to be capable of cutting, such middle part being opposite to the places of contact between the mitre bevel edges of the rollers, whence alone fins can issue, and require the cutting edges to be operative. But as to the two ends of the same cutting edge, the same should be rounded at the side which is to come in contact with the surface of the heated iron, so as not to be

capable of cutting; and those blunt parts of each of the edges will rub along the intended cylindrical surface of the pipe or tube, so as to prevent the surface of the heated iron at each side of the fins being dragged up, as it might otherwise be, by the force of cutting away the fins, because the heated iron is in a very soft state, and the fins, although thin, are part of the solid iron squeezed up therefrom, and firmly engrafted thereto at their bases, so as to require the iron on each side of the narrow base of each fin to be kept firm in its proper intended place (as part of the exterior cylindrical surface of the pipe or tube), whilst the cutting away of the narrow bases of the fin (so as to be in conformity to the said surface) is performed. And the cutting edges being blunt and smooth where they apply to the heated iron on each side of the narrow base of each fin, and sharp cutting at the middle parts, which can alone meet with the fins, the removal thereof may be effectually performed. And note, the peston or mandril *r*, which is within the pipe or tube, will afford internal support to the heated iron thereof at those parts where the four cutting edges apply as aforesaid to the external surface thereof, and sufficient spaces must be left around the said cutting edges between them and the circumferences of the four rollers, for the iron of the fins which are removed by the said four cutting edges to get freely away in fragments and shavings, without clogging up in those spaces, which must be all carefully cleared out every time after a pipe or tube has been passed through between the rollers, and before another such is passed. And note, the same should have been said respecting the dirt, scale, or scoria which will be removed by the four scrapers, 1, 2, 3, and 4, Sheet II., and herein-before described. The four revolving grooved rollers should have the usual fixed scrapers applied to their circumferences for preventing fragments of such dirt, scale, or fragments or shavings of fins being carried round with those circumferences to the places of their contact of one with another. And the streams of water which are usually poured out upon the circumferences of the rollers will find its way in part to the scraping edges or cutting edges aforesaid, in order to keep them from becoming hot, or additional streams of water may be applied.

And another fourth part of my said improvements relates to the furnace which is to be used for heating the iron of turned-up skelps, or of pipes or tubes in preparation for being welded or rewelded, by passing them through between four combined revolving grooved rollers, as herein-before explained, and consists in the disposition of two sets of such rollers in respect to one such furnace. The said furnace, as to its construction, may be the same kind of reverberatory air furnace as is commonly used for so heating as aforesaid, and with a door at each end of the bed of the furnace whereon the iron is to be

laid for being heated; and one welding machine, containing a set of four combined revolving rollers, is placed opposite to each such door, whereby the same furnace will serve for heating the skelps or pipes or tubes for both such welding machines as well as two furnaces could do, but with less consumption of fuel, and less attendance, and less space occupied in the building, see Sheet III., Figure 1, which is a horizontal plan of a furnace E, F, with one welding machine I, J, at one end of the furnace, as usual, and another additional machine *i*, *j*, at the other end of the same furnace. The central lines *z*, *z*, and *&*, *&*, of those two machines, do not correspond in the plan, being about a foot asunder, but parallel one to the other, and upon the same level. The door A, at one end of the furnace, corresponds with the central line *z*, *z*, of one of the machines at I, J; and the additional door *a* at the other end of the same furnace correspond with the central line *&*, *&*, of the other machine, *i*, *j*. The iron is thrown in endways upon the bed of the furnace K, K, through the same door A or *a* at which it is to be taken out again as soon as it has acquired a proper heat for being passed through between the four revolving grooved rollers of that welding machine I, J, or *i*, *j*, which stands opposite to the said door A or *a*, through which the iron is so put in and taken out again. B, B, B, are the holes through which coal is introduced to the fire-place upon the long fire-grate *b*, *b*; and the current of flame proceeding from the fire thereon passing laterally over the long fire-bridge *d*, *d*, strikes upwards beneath the arched roof which extends over the whole furnace, and is reverberated therefrom downwards upon the bed K, K, of the furnace, so as to heat the iron which is laying thereon, and then the current passes by passages *m*, *m*, *m*, *m*, into the main flue M or tunnel which leads to the vertical chimney stack; all which as is usual in such furnaces as they are commonly used. And also such furnaces sometimes have a door at each end of the bed of the furnace, but only one welding machine, which stands opposite to one of these doors (as the machine I, J, stands opposite to the door A), but the other door, such as *a*, has no machine belonging to it, that other door (which is most remote from the machine) being for the purpose of putting the iron into the furnace upon the bed thereof; and after having acquired the proper intended heat, then the iron is drawn out at the door nearest to the machine, in order to be passed through between the four combined revolving rollers thereof, so that the iron is passed through the furnace, being put in through the door at one end, and taken out through the door at the other end thereof, and both the said doors correspond to the central line *z*, *z*, of the one machine. It is not intended to claim the exclusive use of a furnace with a door at each end of it when there is no machinery at one of those doors, but only to

claim the placing of two machines, one at each end of the furnace, which has a door at each end, so as that the same furnace may serve for heating the iron for both machines, as already explained.

And another fifth part of my said improvements is for welding turned up skelps of wrought iron into pipes or tubes, by passing the same through between two revolving grooved rollers over a stationary mandril, with a new kind of mouthpiece applied before such pair of rollers, for introducing the heated iron between them, in such manner as to ensure that the two meeting or overlapping edges of the skelp which are to be welded together into a seam or welded joint shall not fail to be opposite to one of the rollers, whilst passing through between the two, so as to receive the compressure thereof for effecting the welding, and to ensure that such edges cannot get opposite to the junction where the edges of one grooved roller meets those of the other grooved roller. The welding of turned-up skelps of iron by passing them through between two grooved rollers, and with a stationary mandril, is an old and common practice; but for want of some means to ensure that the edges which are to be welded shall keep opposite to one of the grooved rollers, such mode is uncertain of effecting a complete welding of the edges along all the length of a long pipe or tube. Sheet IV. represent machinery constructed according to this fifth part of my improvements. Figure 1 is a side elevation; Figure 2, an end elevation at that end where the turned-up skelp of iron is to be introduced at a welding heat from the furnace into the mouthpiece; Figure 3 is a like elevation at the opposite end, where the iron is to come through welded into a pipe or tube; and Figure 4 is a horizontal plan. The same letters of reference are used to denote the same parts in all the Figures. L, M, are the two grooved rollers fastened on the uppermost ends of two upright axes, *l* and *m*, which are turned round with equal motions by means of two equal spur wheels Q and R, and motion is communicated to the axis *l* by a mitre bevel wheel P thereon, from another such wheel O, which is fastened on the extreme end of a horizontal axis *g*, which axis *g* is turned round by any suitable connection from mill work, or else such connection may be made with the spur wheel G, which is fastened upon the axis *g*; and there must be some convenient means of disconnecting and connecting, in order to stop the machinery, or put it in motion, as may be required. The grooves around the circumferences of the two rollers L and M, are each formed to the concavity of half the circumference of the circle which the exterior of the pipe or tube is to be, after having been welded by passing through the circular aperture *a*, Figure 3, which is left between the two grooves of the rollers L and M. A is the mouthpiece fixed in front of the pair of rollers L, M. The interior of the

mouthpiece is of a pear shape section, suitable for receiving a skelp which has been turned up to a pear-shaped section, as already mentioned at the commencement of the description of Sheet I. The said interior of the mouthpiece A is bell-mouthed, so as to be large enough at the outer end nearest to the furnace for the end of the heated iron skelp to be easily introduced into that large end of the mouthpiece, when a workman draws the iron endway forwards out of the furnace with a pair of tongs, and throws it with a rapid endway motion into the large front end of the mouthpiece; but the inner end of the same mouthpiece A is very little larger than the size of the pear-shaped section of the skelp, so as that the skelp will just pass through, but no more, and therefore the prominent part of the pear-shape of the skelp must of necessity be kept towards the same side of the interior of the mouthpiece, and cannot deviate therefrom. The said prominent side of the interior of the mouthpiece is turned towards the roller M, and towards the deepest part of the concave groove thereof, as is aparent in the Drawing. *r* is the stationary mandril which is between the grooved rollers L, M, and over which the heated iron skelp is to be passed; and R, R, is its long stem, which is sustained at its extreme end by the support S, all which is as usual, and is well understood by workmen. X, Figure 4, shews two different forms which may be given to the end *r* of the stationary mandril. The skelps of a pear-shaped section, whereof the edges are to be welded together by passing them through between the two revolving grooved rollers L, M, as aforesaid, may be such skelps as have been turned up in the ordinary modes, either by a crocodile, or by drawing them through a hole with a draw-bench, but without a mandril being used in either case, and the skelps will then be of a pear-shaped section, to which the interior of the mouthpiece A must be suitably adapted. The skelps so turned up will be best suited for making edge-to-edge joints; or the machinery Sheet I. may be adapted for turning up skelps of a pear-shape section by forming the grooves in the two rollers L, M, Sheet 1, in a suitable manner, and also the mandril F, Sheet I., should be of a suitable form, if any such mandril is used, for it may be wholly dispensed with in case of turning up skelps to a pear-shaped section. And in such manner of using the machinery, Sheet I., the prominent side of the pear shape should not be at the meeting or overlapping edges of the skelp, but at the opposite side to those edges, which edges will be bended in the turning up by the machinery, Sheet I., to the true curvature for the intended cylindrical form of the exterior of the pipe or tube Z, Figure 4.

Sheet IV. represents skelps prepared by the said mode of turning up by the machinery Sheet I., in preparation for being welded by being passed

through the machinery Sheet IV., and skelps may be so turned up either with edge-to-edge joints, or with lapped joints, as may be preferred. In either case the welding will be well performed, the prominent side of the pear-shaped section being pressed into the proper intended cylindrical form by the passing of the iron through between the two grooved rollers L, M, and over the mandril *r*.

And another sixth part of my said improvements in the manufacture of pipes or tubes of that class or kind which are formed by welding skelps of wrought iron is for straightening the pipes or tubes after they have been welded, and still continue red hot, and the iron soft; for although the pipes or tubes are tolerably straight when they pass out from between the four combined revolving grooved rollers of the machinery Sheet II., or from between the two-grooved roller of the machinery Sheet IV., (because in either case the pipe or tube passes over along the stem R, R, of the stationary mandril), nevertheless, from the softness of the iron, the pipes or tubes become bended in the act of drawing them off from the said stem R, R, and therefore require to be straightened, which is usually done by laying the pipe or tube upon a long flat table of cast iron, and with another long flat table over it, which latter is moved backwards and forwards alternately by machinery, whilst it rests upon the pipe or tube by its weight, so as to roll the pipe or tube between the two flat surfaces, and render it straight.

Sheet VI. represents a machine for straightening such pipes or tubes according to this sixth part of my improvements, which operates by extending the tube whilst it continues red hot and is soft, to bring it to a straight line by an adequate force of tension, and keeping it so extended until it is become cool and rigid. Figure 1 is a longitudinal section; Figure 2 an end section of one end; and Figure 3 an end section of the other end. Figure 4 is a plan. A, A, in all the Figures is a horizontal bed of cast iron supported on legs B, B, at each end, precisely the same as the bed of a turning lathe. D, D, and E, E, are two saddles fitted upon the edges of the bed, so as to be capable of sliding along the same. F and G are two puppets, which are fitted upon the said saddles D, D, and E, E. The said puppets are formed like hollow conical boxes, the central line *z*, *z*, of the cones being a straight horizontal line parallel to the edges of the bed A, A, and which line is also to be the central line of the pipe or tube T, when it is mounted in its place for being extended, and thereby straightened. The two ends of the tube T are to be held fast by punching them around two plugs *d* and *e*, which are formed on the ends of two horizontal screws H and I, which screws work in nuts fitted through the puppets F and G, with handle wheels K and R, which

serve as handles for turning those nuts round, and thereby drawing the screws H and I, and the plugs *d* and *e*, endways into the hollow conical boxes. The said plugs *d* and *e*, at the ends of the screws H and I, are fitted truly into the interior of the pipe or tube T, at each end thereof, and four clamps *w*, *w*, *w*, *w*, Figures 1 and 2, are applied round the exterior of each end of the pipe or tube, and within the hollow conical box F or G, so as to compress the end of the tube upon the plug within it. For that purpose the four clamps *w*, *w*, have claws, which enter into a deep groove around the plugs *d* and *e*, so as that, when the screw *h* or I is drawn further into the hollow of the conical box F or G, by turning its handle wheel K or R, it will carry the four clamps *w*, *w*, with it, and owing to the conical form of the interior of the hollow box they will become so forcibly pressed upon the end of the tube as to hold it very fast. When the machine is to be used the puppet F and its saddle D are to be clamped fast down to the bed A at a proper distance from the other puppet G, so as to suit the length of the pipe or tube which is to be straightened, but to allow the ends thereof to be be introduced between the ends of the two plugs *d* and *e*. And first one end is inserted on the plug *d*, and within the four clamps *w*, *w*, which have been previously loosened around that plug *d* by turning back the handle wheel K; but after such insertion of the end of the tube, the said handle wheel K, being turned round forwards, will draw the screw H, and the four clamps *w*, *w*, tight around the end of the plug *d*, so as to take fast hold of that end of the tube T; then by turning another handle wheel W, which is fastened on a nut mounted in a standard V, that is part of the saddle E, and as the screw I works in the said nut, that screw is moved endways, carrying the puppet G with it until the plug *e* at the end of the screw I enters into the other end of the tube T, with the four clamps *w*, *w*, surrounding that end, those clamps having been previously loosened by turning back the handle wheel R; then by turning forwards the handle wheel R, the said clamps *w*, *w*, will take fast hold of the said end of the tube T, which thereby becomes fastened by its two ends in its intended position in the machine; after which, by turning the handle wheel W forwards, the screw I and puppet G, together with the end of the tube T, is drawn endways, so as to extend the tube lengthways until it is rendered straight. But to avoid so extending with more force than is proper for the pipe or tube to endure, the saddle E, E, is not clamped or fastened to the bed A, but is let loose thereon with a chain *m*, Figure 1, fastened to the saddle E, and passing over a pulley N, and having a weight *x* appended to the end of the chain *m*, for drawing the saddle E endways along the bed A; and after the pipe or tube has been so extended and straightened,

and is left to cool, the contraction of the iron in cooling will be allowed by the saddle E sliding along the bed and raising the weight *x* a very small distance. The plugs *d* and *e*, and the clamps *w*, *w*, are to be changed for others when required, in order to suit pipes or tubes of different sizes; and another puppet (not shewn in the Figures) may be fitted to slide along the bed A, and having a concave semicircular rest suited to the size of the exterior of the pipe or tube, and concentric with the horizontal central line *z*, *z*, for bearing up the pipe or tube at the middle of its length when it is extended as aforesaid, and preventing it from bending down by the weight of the iron. This will be useful for long pipes or tubes. The machine, Sheet V., may be set up with the bed A, A, in a vertical instead of a horizontal position, if preferred.

And another seventh and last part of my said improvements is for cutting off the two ends of each pipe or tube to the exact length that is required, which has usually been done by a circular saw turned rapidly round by machinery.

Figures 2 and 3, Sheet III., represent a machine of the nature of a turning lathe, for cutting off the two ends of a pipe or tube. A, A, is the cast iron bed, supported on legs B, B, at each end. F and G are two puppets fitted upon the bed A, so as to slide along the same, and fasten thereon at any part of the length by means of clamping screws and nuts applied in the usual manner of lathe puppets. Each of the puppets F and G is formed to receive and sustain a hollow revolving mandril or tubular axis H and I, so as that the same will revolve truly and steadily in brass bearings suitably for the pipe or tube T, which is to be cut off, to be inserted through the hollows of the two revolving mandrils H and I. K and L are two spur cog wheels fastened to the ends of the said revolving hollow mandrils, for the purpose of turning them both round with corresponding revolving motions, by means of two pinions *k* and *l*, which are fastened upon a long horizontal axis M, extending all the length of the bed A at the back or behind the puppets F, G. The said long axis M has pullies N, of four different sizes, fastened upon one end of it, for the purpose of turning the axis M round with different speeds by means of an endless strap or belt passing around one or other of the said pullies N, and around one or other of corresponding pullies (not represented), which are turned round by millwork. The pinions *k* and *l* give a slow and regular motion to the spur wheels K and L, and to the two hollow mandrills H and I, for turning them round, together with the pipe or tube T, which is sustained within their hollows, and for fastening the tube T into the said two hollows,

so as that the tube T shall be sustained therein concentrically with the horizontal central line z, z, of the two hollow mandrils H and I. Each of the spur wheels K and L is constructed in the manner of what are termed universal chucks, with three clamps, moveable by three radial setting screws; that is to say, each wheel K or L has three grooves in it, in the direction of radii, with slides r, r, r, Figure 3, fitted into those grooves, and screws in the grooves for moving the sliders therein either towards the centre or the contrary. The said sliders, and the clamps s, s, s, which are fastened upon them, can therefore be screwed up, in order to include the pipe or tube amongst all the three clamps s, s, s, so as to sustain the tube firmly whilst it is being carried round by the revolving motion given to the two hollow mandrils, as already explained; and the cutting off is performed by suitable turning tools, held in two slide rests Q, Q, having horizontal sliders disposed parallel to the length of the bed A, A, with cross sliders R, R, and holders P, P, for sustaining and holding the turning tools which are advanced towards the tube T by endway motion given by screws to the cross sliders, so as to cut the iron of the tube as it is turning round, in the manner of turning in a turning lathe. The longitudinal sliders are moveable by screws, and serve to set the turning tools to the exact length to which the pipe or tube is to be cut off. The pinions k and l can be slided along the lengthways of their axis M, and fastened thereon to suit the places where the spur wheels K and L may be, according to the length of the pipe or tube T. The sliders r, r, r, have the clamps s, s, s, applied and fastened upon them in the manner of change pieces, which can be removed, and others fastened upon the sliders r, r, r, in their places, in order to suit pipes or tubes T, of different sizes, as may be required. And note, common turning lathes with slide rest have been used for cutting off the ends of pipes or tubes; but this kind of turning lathe, with two hollow revolving mandrils, is more convenient, and cuts off both ends of the pipe or tube at the same time, or at once mounting of the pipe or tube in the machine. The cutting tools, after having been set for cutting off the ends of one tube, and being then withdrawn by endway motion of the cross sliders by which they are sustained, the tube can be removed by unscrewing one of the radial screws of the sliders r, r, r, and another similar tube put in, and then fastened by screwing up that radial screw; after which the cutting tools, being advanced by endway motion of the cross sliders, will cut off the ends of the tube to exactly the same length as the preceding tube was cut off to, and so on of any number of tubes which may be required to be alike.

Having now described my said improvements, I, the said George Selby, do hereby declare that the new Invention whereof the exclusive use is granted to

me by the Letters Patent herein-before recited, consists in the following particulars, videlicet:—

Firstly, in the improvement herein-before described in reference to Sheet I. of the Drawings hereunto annexed for turning up skelps of wrought iron, with the edges thereof meeting or overlapping, in preparation for being welded to form pipes or tubes, the turning up being performed by passing such skelps, when at a red heat, between a pair of revolving rollers, which are so formed as to turn up the two border edges of the skelp to portions of the circular form that the whole breadth of the skelp is immediately afterwards to be turned up to, but leaving the middle part of the breadth of the skelp in its flat state, as herein-before explained; and the iron, after having had its two borders turned up in that manner, passing (in its progress onwards) between fixed guiding cheeks, for gathering the said two turned-up sides of the iron towards each other sufficiently for the iron passing (in its further progress onwards) between a pair of revolving grooved rollers, which complete the turning up to a cylindrical form around a stationary mandril, the said two pairs of revolving rollers being turned round by the power of mill work with like velocities.

Secondly, in the improvement herein-before described in reference to Figures 1, 2, 3, 4, 14, and 16, Sheet II., for clearing off dirt, scale, or excess of scoria from the exterior surface of cylindrical skelps of turned-up iron, or else pipes or tubes of iron once welded to a cylindrical form, and which skelps or pipes or tubes are passing when at a welding heat through between four combined revolving grooved rollers, for the purpose of being welded or rewelded by so passing, the said clearing being performed by four scrapers applied at the mouthpiece in front of the said four rollers, in order to act in concert around the external surface of the heated iron after it has passed through the said mouthpiece, but immediately before it has entered between the said four rollers, the said four scrapers operating to scrape off dirt and excess of scoria from the said surface by the rapid endway motion wherewith the heated iron is passing through between the said scrapers, in consequence of being propelled by the revolving motion of the four rollers, the said four scrapers being at the ends of stems mounted around the said mouthpiece on centre pins in the manner of levers, which stems reach into the space between the four rollers so as to apply the scrapers beyond the end of the mouthpiece near to the apperture between the said rollers, and the said scrapers being brought into contact with the heated iron by action of springs applied to the tail ends of the stems, so as to render the four scrapers capable of yielding in case of accident, but with setting screws for regulating the approach of the scraping edges towards the iron, and each of the said four scraping edges extending around more than one fourth part of the whole circumference of the heated

iron, so as that no part of that circumference can escape their scraping action, the said four scrapers being separated or opened one from the other, and kept so opened by suitable action on the tail ends of the stems of the scrapers in opposition to their said springs, in order to allow the foremost end of the heated iron to be passed through between the scraping edges without touching, when that said end is first introduced from the furnace and through the mouth-piece in order to insert it into the aperture between the four revolving grooved rollers; but as soon as the end of the heated iron begins to be so inserted, and therefore first comes in contact with the end of the piston or mandril, then the pressure which the iron will exert at the moment of such first contact will move the mandril a little endways, and by such motion endway the stems of the four scrapers will be instantly set at liberty, to be operated upon by their respective springs, so as to close all the four scraping edges suddenly together around the heated iron in contact with the external surface thereof, in order to commence the scraping action at the moment when the heated iron begins to be passed through between the four revolving grooved rollers, and over the stationary mandril, as herein-before described.

Thirdly, in the improvement herein-before described in reference to Figures 2, 5, and 6, Sheet II., for removing all projecting fins from the exterior surface of heated iron skelps, or pipes or tubes, which are passing, when at a welding heat, through between the four combined revolving grooved rollers, for the purpose of being welded or rewelded by so passing, the said removing being performed by four fixed cutters applied and firmly fastened to a fixed plate at the back of the said four rollers, in order to act in concert with their cutting edges, so close to the proper intended cylindrical surface of the pipe or tube as to cut away and remove any fins which may project beyond that said cylindrical surface, the cutting action taking place by the endway motion wherewith the heated iron is propelled through between the four rollers, and so taking place immediately after the said heated iron has passed through and come out from the aperture between the four rollers, the said four fixed cutters reaching into the space between the four rollers so far as to apply their cutting edges to the heated iron very near to the aperture between the four rollers from which the heated iron is so coming out, and very near to where the piston or bull end of the stationary mandril is within the heated iron.

Fourthly, in the improvement herein-before described in reference to Figure 1, Sheet III., of placing two welding machines, (such as that represented in Sheet II., containing four combined revolving grooved rollers, or such as represented in Sheet IV., containing two combined revolving grooved rollers) at the opposite ends of the same furnace, for heating the iron of the turned-up skelps, (or of the pipes or tubes), which are to be welded, (or to be re-welded),

by being passed through between the revolving rollers of such machines, the furnace having a door at each end, and being otherwise constructed as usual, but serving for both machines, as herein-before explained.

Fifthly, in the improvement herein-before described in reference to Sheet IV., of applying a new kind of mouthpiece to two revolving grooved rollers combined for the purpose of guiding skelps of iron which have been turned up to a pear-shaped section, when such skelps are withdrawn from the furnace at a welding heat, and the foremost ends thereof are inserted into and passed through such mouthpiece, in order to be thereby entered and passed through between the said two revolving grooved rollers, the guidance being effected by the prominent side of the pear-shaped section fitting into a corresponding form of the interior of the said mouthpiece, and that guidance being such as to ensure that the edges of the skelps which are to be welded shall be opposite to one of the two grooved rollers, whereby those edges will receive a proper compression for being welded together. The skelps may be turned up to such pear-shaped section either by any ordinary mode of turning up, or by operation of the machinery, Sheet I., as herein-before described.

Sixthly, in the improvement herein-before described in reference to Sheet V., for straightening pipes or tubes after they have been welded, and whilst they remain red hot, by extending them in length, so as to bring them to a straight line in the manner herein-before described.

Seventhly and lastly, in the improvement herein-before described in reference to Figures 2 and 3, Sheet III., for cutting off the two ends of each pipe or tube to an exact length, in a machine of the nature of a turning lathe, but constructed with two hollow revolving mandrils, which are turned round with like motions, and through which the pipe or tube is inserted, and by which its two ends are supported and turned round in a proper manner for being cut off true and smooth at each end, by turning tools applied in suitable slide rests to cut at each end of the tube or pipe where those ends project out through the two hollow mandrils. It is not intended to claim the cutting off the ends of the pipes or tubes in a turning lathe with turning tools in a slide rest or rests, but only to claim the cutting off the ends of the pipes or tubes in the aforesaid kind of cutting lathe, with two hollow revolving mandrils, as herein-before described.

In witness whereof, I, the said George Selby, have hereunto set my hand and seal, this Eighth day of September, One thousand eight hundred and forty-five.

GEORGE (L.S.) SELBY.

Selby's Improvements in the Manufacture of Pipes and Tubes.

SENIOR.

AND BE IT REMEMBERED, that on the Eighth day of September, in the ninth year of the reign of Her Majesty Queen Victoria, the said George Selby came before our said Lady the Queen in Her Chancery, and acknowledged the Instrument aforesaid, and all and every thing therein contained and specified, in form above written. And also the Instrument aforesaid was stamped according to the tenor of the Statute made in the fifty-fifth year of the reign of His late Majesty King George the Third.

Inrolled the Eighth day of September, One thousand eight hundred and forty-five.

LONDON:
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